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1st Regulatory Working Group Meeting Regulatory framework for EV charging points connection to the distribution grid

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)

Comprehensive Technical-Regulatory Advisory to enhance RE-based share in electricity grids of Western Balkans

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Western Balkans

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1. Introduction

This report discusses a conducive legal and regulatory framework for E-mobility, focusing on connecting EV charging points to the distribution grid.

Grid code compliance refers to EV charging stations' compliance with the technical requirements and regulations set by utilities and grid operators. Ensuring the smooth integration of EV charging infrastructure into the existing grid is crucial. It helps maintain grid stability, prevent power disruptions, and ensure efficient energy management.

Non-compliant charging stations may cause grid faults, energy wastage, and safety hazards.

Meeting grid code compliance in EV charging poses several challenges for stakeholders involved in developing and operating charging infrastructures. Some of the key challenges include:

- **Power Quality**: EV charging can introduce disturbances in the power system, such as harmonics and voltage fluctuations, which must be addressed to maintain power quality within permissible limits.
- **Interoperability**: As multiple EV models and charging stations from different manufacturers coexist, ensuring interoperability and compatibility among various charging equipment becomes a challenge.
- **Charging Demands**: Effective load management and demand response strategies are required to manage charging demands during peak periods and avoid grid overload.
- **Communication and Control**: Establishing efficient communication and control mechanisms between charging stations and the grid is essential for real-time monitoring and management.

To overcome the challenges associated with grid code compliance in EV charging, various solutions have been proposed and implemented:

- **Smart Charging Infrastructure**: Implement a smart charging infrastructure that intelligently prioritises and distributes charging load, considering grid constraints and user preferences.
- **Advanced Metering and Monitoring**: Advanced metering and monitoring systems are incorporated to measure real-time power quality, energy consumption, and charging infrastructure performance.
- **Standardization and Certification**: Standardised protocols and certification processes for charging stations and related equipment should be encouraged to ensure interoperability and compliance with grid codes.
- **Demand Response Programs:** Implementing demand response programs that incentivise users to charge during off-peak times, reducing the strain on the grid during peak periods.

By adopting these solutions, stakeholders in the EV charging ecosystem can ensure grid code compliance, enhance overall system efficiency, and contribute to the successful integration of EVs with the existing grid.

2. EU Regulatory Framework for E-mobility

This paper shall assess the following set of EU legislation that covers EV recharging points divided into the following categories:

E-MOBILITY	
Subject of regulation	**Legal act**
Alternative fuels infrastructure	• Regulation 2023/1804/EU on the deployment of alternative fuels infrastructure repealing Directive 2014/94
Electricity market and EV recharging points	• Directive 2019/944 on common rules for the internal market for electricity
Use of energy from renewable sources	• Directive 2018/2001 on the promotion of use of energy from renewable sources and • Directive EU/2023/2413 amending Directive 2018/ 2001/EU
Energy performance of buildings	• Directive 2018/844 on the energy performance of buildings and energy efficiency
Clean and energy-efficient road transport vehicles	• Directive 2019/1161 on the promotion of clean and energy-efficient road transport vehicles amending Directive 2009/33/EC

2.1. Alternative fuels infrastructure (Regulation 2023/1804/EU on the deployment of alternative fuels)

The Regulation 2023/1804/EU will enter into force on April 13, 2024. It establishes mandatory national targets for the deployment of sufficient alternative fuel infrastructure for road vehicles and lays down common technical specifications and requirements for user information, data provision, and payment requirements for alternative fuel infrastructure.

Alternative fuels that meet the minimum criteria of fuels or power sources, i.e., (i) are substitutes for fossil oil sources and (ii) have the potential to contribute to decarbonisation of the transport sector, include, e.g., electricity (for EVs), hydrogen, biofuels, CNG, LNG, LPG, etc.

Recharging points for EVs are defined as interfaces capable of charging or exchanging a battery of one EV.

Recharging points can be classified as **normal (3.7 kW to 22 kW capacity) and high** (above 22 kW capacity - for public use). EV power chargers below 3.7 kW power capacity are considered power chargers for domestic use.

A recharging point means a fixed or mobile, on-grid or off-grid interface for the transfer of electricity to an electric vehicle which, although it may have one or more connectors to accommodate different connector types, is capable of recharging only one electric vehicle at a time, and which excludes devices with a power output less than or equal to 3.7 kW the primary purpose of which is not the recharging of electric vehicles.

This Regulation also provides detailed technical specifications for the recharging points (see Annex II of the Regulation (EU) 2023/1804): technical specifications for socket outlets, connectors, contact interfaces, access for users with disabilities, communication exchange, and others.

According to repealed Directive 2014/94, Member States had to adopt National policy frameworks on EV recharging points by 31 December 2020 to ensure the development of appropriate recharging infrastructure for utilising alternative fuels in the transport sector.

The main goal of the national policy frameworks was to ensure that electric vehicles could circulate uninterrupted, at least in urban/suburban agglomerations and other densely populated areas. It was also stressed that installing recharging points should be accessible to the public and close to public transport stations where appropriate.

The operators of the EV charging points have the right to provide electric vehicle recharging services to customers on a contractual or ad hoc basis without entering into a formal contract relationship with the electricity supplier or operator concerned. The operators must charge transparent and non-discriminatory prices to end users for these services.

Directive 2014/94 /EU also regulated that the electricity supply contract for a recharging point operator should differ from the supplier supplying electricity to the household or premises where such a recharging point is located.

According to Regulation 2023/1804/EU, the operator of a recharging point is an entity responsible for managing and operating the point and providing recharging service to end users.

This regulation also includes new requirements for recharging points, including:

- **Automatic authentication** means vehicle authentication at a recharging point through the recharging connector or telematics.
- **Bidirectional recharging** is a smart recharging operation in which the direction of the electricity flow can be reversed, allowing electricity to flow from the battery to the recharging point it is connected to.
- **Smart recharging** is an operation in which the intensity of electricity delivered to the battery is adjusted in real-time based on information received through electronic communication.

The Regulation sets ambitious targets for developing recharging infrastructure for light-duty and heavy-duty vehicles.

Publicly accessible recharging pools need to be built in each road direction and have a maximum distance of 60 km between them. The minimum conditions for installation of recharging pools are:

- By 31 December 2025, each recharging pool must offer a power output of at least 400 kW and include at least one recharging point with an individual power output of at least 150 kW
- by 31 December 2027, each recharging pool must offer a power output of at least 600 kW and include at least two recharging points with an individual power output of at least 150 kW;

In addition, the recharging pools must be easy to access from both directions of travel and adequately marked and signposted.

Operators of recharging points shall allow the end users to recharge their electric vehicles ad hoc at the publicly accessible recharging points. They must accept electronic payments through payment card readers, devices with a contactless functionality that is at least able to read payment cards, and for publicly accessible recharging points with a power output below 50 kW, devices using an internet connection that allow for secure payment using a specific Quick Response (QR) code.

Operators of recharging points with an automatic authentication system should enable end users to have the right to choose whether they will use the automatic authentication or recharge their vehicle on an ad hoc basis.

Operators of publicly accessible recharging points must charge reasonable, easily and clearly comparable, transparent, and non-discriminatory prices.

At publicly accessible recharging points with a power output equal to or more than 50 kW, the ad hoc price charged by the operator must be based on the price per kWh for the electricity delivered. In addition, the operators of those recharging points can charge an occupancy fee as a price per minute to discourage long occupancy of the recharging point. They must show the ad hoc price per kWh and any possible occupancy fee expressed in price per minute so that that information is known to end users before they initiate a recharging session.

Operators of publicly accessible recharging points with a power output of less than 50 kW must make the information on the ad hoc price clearly and easily available, with all its price components, so that that information is known to end users before they initiate a recharging session and price comparison is facilitated. The applicable price components must be presented in the following order:

- price per kWh
- price per minute
- price per session and
- any other price component that applies.

2.2. Electricity market and EV recharging points (Directive 2019/944 on common rules for the internal market for electricity)

The market rules set out in Directive 2019/944 on common rules for the internal market for electricity contribute to creating favourable conditions for building alternative fuels infrastructure, i.e. recharging points for EVs. They also call for the efficient integration of vehicle charging into the electricity system.

The directive requires DSOs (distribution system operators) to include EV recharging points in their network development plans. The plan must outline the planned investments for the next five to ten years and emphasize the main distribution infrastructure required to connect new generation capacity and new loads, including recharging points for electric vehicles (art.32 paragraph 3).

Member States must prescribe rules for DSOs to connect publicly accessible and private recharging points to the distribution networks.

The Directive also prescribes that EV recharging points be equipped with intelligent metering systems if technically feasible and economically reasonable.

In case of refusal of access to the grid where the appropriate system operator lacks the necessary capacity, DSOs shall be obliged to provide duly substantiated reasons for refusal based on objective, technically and economically justified criteria.

The regulatory authorities must ensure that the TSO or DSO provides relevant information on measures necessary to reinforce the network when access is refused. When access to recharging points has been denied, such information must be provided. The party requesting such information may be charged a fee.

The Directive regulates that Distribution system operators shall not own, develop, manage or operate recharging points for electric vehicles, except where they own private recharging points solely for their own use (art.33 paragraph 2).

However, there is derogation from this rule in certain situations:

- When there is no interest by other parties to own, develop, manage or operate recharging points after implementation of open, transparent and non-discriminatory tendering procedure by the regulatory authorities
- the services could not be delivered at reasonable costs and in a duly and timely manner for consumers by other operators
- the regulatory authority has carried out an ex-ante review of the conditions of the tendering procedure under point (a) and has granted its approval;
- the DSO operates the recharging points based on third-party access and does not discriminate between system users.

The Directive provides for the possibility of re-assessing the granted rights to DSOs to encourage the entry of other potential operators—at least every five years, based on a public consultation conducted to re-assess the potential interest of other parties in owning, developing, operating or managing recharging points for electric vehicles.

If the public consultation indicates that other parties can own, develop, operate or manage such points, Member States must ensure that DSO activities in this regard are phased out, subject to the successful completion of the tendering procedure. As part of that procedure, regulatory authorities may allow the DSO to recover the residual value of its investment in recharging infrastructure.

2.3. Use of Energy from Renewable Energy sources (Directive 2018/2001 on the promotion of use of energy from renewable sources and Directive 2023/2413 amending Directive 2018/2001)

Directive 2018/2001 regulated that by 31 December 2021, Member States must take measures to ensure the availability of fuels from renewable sources for transport, including publicly accessible high-power recharging points and other refuelling infrastructure.

Amended Directive EU/2023/2413 prescribes that national regulations and building codes must enable the increase in the share of electricity and heating and cooling from renewable sources produced on-site. These measures may refer to increases in renewable self-consumption, renewable energy communities, local energy storage, smart recharging and bi-directional recharging, other flexibility services such as demand response, and energy efficiency improvements.

Smart recharging refers to EV charging with additional functionalities like setting a charging time, monitoring charging, energy load management, remote operation start/off, etc. Bidirectional recharging enables charging and discharging the EV back into the grid or home.

Directive EU/2023/2413 also refers to upgrading normal power recharging points and requires that new and replaced non–publicly accessible normal power recharging points installed can support smart recharging functionalities, the interface with smart metering systems, and bidirectional recharging functionalities.

According to Article 25 (paragraph 4), Member States must establish a mechanism allowing fuel suppliers in their territory to exchange credits for supplying renewable energy to the transport sector.

Economic operators that supply renewable electricity to electric vehicles through public recharging points shall receive credits and may sell those credits to fuel suppliers. Private recharging points may be included in that mechanism if they demonstrate that renewable electricity supplied to those private recharging points is provided solely to electric vehicles.

2.4. Energy Performance of Buildings (Directive 2018/844 on the energy performance of buildings and energy efficiency)

Directive 2018/844 on the energy performance of buildings and energy efficiency regulates the criteria and conditions for installing EV charging points in residential and non-residential buildings.

Member States must simplify the deployment of recharging points in new and existing residential and non-residential buildings. This measure must include overcoming institutional barriers in permitting and approval procedures.

Non-residential buildings with more than 20 parking spaces will be subject to prescribed requirements for installing a minimum number of recharging points. These requirements should be set by 1 January 2025.

The new non-residential buildings and non-residential buildings undergoing major renovation, with more than ten parking spaces, must ensure the future installation of at least one recharging point.

In addition, conduits for electric cables must be provided for at least one in every five parking spaces to enable the later installation of recharging points for electric vehicles where the car park is located inside the building or is physically adjacent to the building.

The new residential buildings and residential buildings undergoing major renovation, with more than ten parking spaces, must ensure the installation of ducting infrastructure, namely conduits for electric cables, for every parking space to enable the installation, at a later stage, of recharging points for electric vehicles.

2.5. Clean and Energy-Efficient Road Transport Vehicles (Directive 2019/1161 on promotion of clean and energy-efficient road transport vehicles)

Directive 2019/1161 on promoting clean and energy-efficient road transport vehicles requires all EU Member States to ensure the transport sector's contribution to the environment and climate protection by considering the lifetime impacts of CO2 on the environment when procuring certain road transport vehicles. The Directive sets minimum procurement targets for alternative fuel vehicles. For each country, it prescribes the share of contracts for the purchase, lease, rent or hire of clean, light-duty, and heavy-duty vehicles—in total number of contracts (Table 3 and Table 4 of the Annex). The targets are set for the first reference period (2 August 2021 - 31 December 2025) and the second reference period (1 January 2026 - 31 December 2030).

3. International experience with the development of charging infrastructure and best practices on legislation/policies

3.1. Ireland

The standards for EV recharging points in Ireland are regulated by the Universal Design Guidelines for Electric Vehicle Charging Infrastructure adopted by the Minister of Transport. The act includes recommendations on the design, placement, and provision of information on EV charging infrastructure. The Guidelines ensure that recharging an electric vehicle is a universal service for all citizens. Special attention is paid to the guidelines on public access to EV recharging points, especially for enabling access for people with disabilities.

The Guidelines contain rules for EV recharging sites, design of the recharging station, site accessibility for all categories of users (individuals, families, elderly people, people with disabilities, etc.), and providing information for users before, during, and after a charging session.

More specifically, the Guidelines regulate the following:

- Parking bays should be designed to accommodate all users to get in and out of their vehicles, move around the vehicle safely, access the charging station, and park comfortably
- The public charging station must be installed on a flat, stable, and non-sloping surface with adequate grip
- Where possible, the charging stations should be positioned on the same level as the roadway to allow for easy access
- Obstacles around the charging station should be removed where possible
- Charging stations should be installed as close as possible to any available amenities in the immediate vicinity, such as shops, toilets, cafes, or other services
- Where possible, adequate overhead weather protection should be placed around charging stations
- Ensuring a safe and secure charging environment is essential for all users.
- Adequate and consistent lighting following relevant standards throughout different parts of the day is crucial
- The charging station should be placed in such a way that it does not obstruct sightlines for other road users and can be safely operated
- Barriers or policies that would prevent access to the public charging station at any time of the day should be avoided (e.g., height restrictions)
- To ensure the safety and protection of the charging station from potential vehicle impact damage, impact protection measures such as wheel stops should be installed in high-risk areas
- To ensure safe and accessible use of the charging stations, operators should ensure that electric vehicle charging infrastructure is kept in proper working condition throughout its commercial lifetime and that the quality and access of charging stations are maintained
- Emergency Stop Button - fast-charging stations should provide a covered stop button that, in case of an emergency, could be pressed to halt the charging process
- The tethered cable length should be long enough to reach any vehicle with varying socket positions.

The Guidelines also make recommendations for the use of the latest innovation and technology solutions on EV recharging points like:

- **Inductive Charging:** This allows electric vehicles to be charged without cables by using a wireless charging pad placed on the ground.
- **Robotics:** Robotics refers to using machines and robots to automate charging electric vehicles.
- **Battery Swap Technology:** Battery swap technology can improve the accessibility of electric vehicle charging infrastructure by providing more charging options.
- **Plug and Charge:** Plug and charge technology allows electric vehicle drivers to simply plug in their vehicle and start charging without the need for additional steps such as authentication or payment.
- **Improved Battery Technology:** Battery technology advancements can significantly affect accessibility to electric vehicle charging infrastructure.
- **Mobile Charging Units:** Mobile charging units are portable stations that can be brought to electric vehicles that need to be charged. They make charging more accessible in remote or hard-to-reach areas.
- **Dynamic Wireless Charging:** Dynamic charging technology enables electric vehicles to charge wirelessly while driving on the road, making charging more accessible for long-distance travel.
- **High-power Charging:** High-power charging technology enables faster charging times for electric vehicles.
- **Payment Versatile** and user-friendly (e.g. tap-and-go) payment methods should be provided to accommodate a range of user needs and make the process as simple and clear as possible.

3.2. Germany

In Germany, the EV's recharging points are regulated by the Ordinance on Minimum Technical Requirements for the Safe and Interoperable Construction and Operation of Publicly Accessible Charging Points for EVs (Charging Stations Ordinance).

Pursuant to the Ordinance, the recharging point means a device at which only one EV can be charged or discharged at the same time, and which is suitable and intended for charging or charging and unloading EVs.

A standard charging point means a charging point where electricity with a charging power of no more than 22 kilowatts can be transmitted to an EV, and a fast-charging point means a charging point where electricity with a charging capacity of more than 22 kilowatts can be transmitted to an EV;

A recharging point must be publicly accessible if the parking space belonging to the recharging point can be accessed by an indeterminate group of persons or only identifiable according to general characteristics unless the operator has restricted the use to an individually determined group of persons at the recharging point or in the immediate vicinity of the recharging point using a visible marking or signposting; the group of persons is not determined solely by the fact that the use of the charging point is made dependent on registration.

Regarding technical security and interoperability, the Ordinance requires the following:

- for normal and fast charging points where AC charging is possible, each charging point must be equipped with at least one socket or coupling of type 2 in accordance with the technical standard DIN EN 62196-2

- for charging points where DC charging is possible, each charging point must be equipped with at least one Combo 2 coupling in accordance with the DIN EN 62196-3 technical standard.

When setting up recharging points, a standardised interface must be in place to transmit authorisation and billing data, as well as dynamic data on operational readiness and occupancy status.

Wireless and inductive charging points are exempt from compliance with DIN Standards.

The operator of a charging point must enable users of EVs to choose the manner and conditions for payment in cash at the vicinity or cashless via a contactless debit card with enabling payment authentication. Payment for EV recharging can also be made possible using a common web-based system if the menu navigation is available in German and English and at least one variant of access to a web-based payment system.

Operators of recharging points shall notify the regulatory authority electronically of their commissioning and decommissioning. They must prove to the regulatory authority that they comply with the technical requirements by attaching appropriate documents. The regulatory authority may specify the manner and scope of the notification regarding the commissioning of charging points or if charging points are taken out of service.

The regulatory authority may regularly review compliance with the technical requirements referred to and prohibit the operation of a charging point if a technical requirement is not met.

Charging points with a capacity of no more than 3.7 kilowatts are exempt from the obligation to notify regulatory authorities.

3.3. Netherlands

According to the respective Decrees in the Netherlands, in case of a commercial building with parking spaces or in case of a major renovation of the commercial building, the investor must have charging points for EV i.e. at least 1 charging point on 10 parking spots and 1 in 5 parking spots must have a connection to a charging station.

A charging point is not mandatory if the costs of the charging station (design, materials, and installation) amount to more than 7% of the renovation costs.

Starting in 2025, all commercial buildings with more than 20 parking spaces must have at least 1 EV recharging point.

The Decree requires EV recharging points to be installed in accordance with the national technical requirements. They should be accessible to the public and equipped with a secure measuring device to ensure adequate protection of data traffic and privacy provided by final customers. A publicly accessible charging point provides electric vehicle users with an ad-hoc charging service that does not require a contract with an electricity supplier or recharging point operator.

The measuring device must record and display the current power in watts and provide information on the actual time of consumption.

3.4. United Kingdom

The EV Recharging points in the UK are regulated with the Public Charge Point Regulation 2023 and Design Guidance Accessible Charging 2022.

A public charge point includes a charge point that:

- may only be accessed during specific hours or
- is situated in a public car park, whether or not that car park is available only to persons intending to purchase specific goods or services.

The Regulation contains provisions on pricing transparency, i.e. displaying the unit of measurement used for pricing.

A charge point operator must ensure that the total price for charging an electric vehicle through a public charge point is displayed in pence per kilowatt-hour either on the charge point or through a separate device, which does not require a person to have entered into a pre-existing contract with the charge point operator.

The regulation requires providing conditions for contactless payment for a new public charge point with a power of 8 kilowatts or above.

The regulation also sets an obligation for the reliability of EV charge points in terms that the operator must provide reliability 99% of the time during each calendar year for rapid EV recharging points.

3.5. Austria

EV recharging points in Austria are regulated by the Law on Clean Energy in Transport. At the regional level, each federal state adopted strategies to promote the use of EVs and mitigate the overall carbon dioxide levels in the atmosphere.

3.6. Italy

In 2017, Italy adopted Legislative Decree n. 257, known as the DAFI (Directive Alternative Fuel Initiative). The DAFI set the general objective of achieving an adequate number of recharging points for EVs in Italy. Their number will be determined based on an estimation of the number of EVs that will be purchased by the end of 2020.

The decree also establishes an obligation for Italian public authorities to procure EVs for their needs and achieve at least 25% of the fleet.

Furthermore, according to the DAFI, municipalities are required to update their building regulations to meet requirements for the deployment of alternative fuel infrastructure. Starting on 1 June 2017, new buildings and significantly renovated ones must provide connection points for EV recharging.

4. Tariffs and costs for EV recharging

The Operators of public recharging points charge different types of tariffs and costs to the end users. Usually, EV recharging tariffs differ from service provider to service provider. Payment can be against an issued invoice from the Operator to the end user per month for all recharging sessions in that month. This type of invoicing is applied to users who have a membership card. Another way for charring is instantly or pay-as-you-go for ad hoc payers or roaming users.

Tariffs on EV Recharging services can differ in:

- Charging Method
  - Price per kWh
  - Price per minute
  - Price per session
- Location of the EV recharging point
  - Urban area
  - Suburban area
  - Magistral road
- Period of EV recharging session:
  - High tariff period
  - Low tariff period
  - Smart charging (option for pausing recharging session during high tariff period)
- Type of the recharging point:
  - normal recharging point up to 22 kW power capacity
  - high-power recharging point from 22 kW to 150 kW capacity and
  - ultra-rapid charging points 150 kW +
- Type of payment:
  - Membership card for EV recharging
  - ad hoc payment with debit/credit card or contactless card
- Use of roaming service:
  - EV recharging at recharging points operated by the different service providers
- Ubitricity (on-street) tariffs:
  - EV recharging from public lightening infrastructure operated by recharging point operator

Costs that can be associated with EV recharging service can be:

- Transaction costs:
  - Charged to end users who opt to pay contactless or are not members of the EV recharging operator's group
  - Roaming fee for access to EV recharging point
- Blocking fee:
  - Charged to end users for occupancy of the recharging point space for parking after end of recharging session (additional charge per minute)
- Public taxes:
  - VAT
  - Communal tax, etc.